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THE EFFECT OF IMPLANTS COATED WITH TANTALUM AND ITS DERIVATIVES ON THE EXPRESSION OF PROTEINS RELATED TO PROLIFERATION AND ANGIOGENESIS

Background. Polypropylene implants (PPI) are widely used for chest and abdominal wall reconstruction and may serve as an inexpensive material for the reconstruction of small- and medium-sized skull defects. However, their use may be associated with inflammatory reactions. Tantalum-based coatings may improve the tissue response to PPI. **Aim.** To evaluate the effects of tantalum-based coatings on Ki-67 expression and vascularization of granulation tissue surrounding PPI. **Methods.** Forty male WAG rats (5–6 months, 220 ± 20 g) were randomly divided into six groups: intact control ($n = 6$), surgery without implantation ($n = 6$), and PPI coated with tantalum (Ta, $n = 7$), tantalum pentoxide (Ta_2O_5 , $n = 7$), tantalum nitride (TaN, $n = 7$), or uncoated PPI ($n = 7$). The experiment lasted 28 days. Ta, Ta_2O_5 , and TaN coatings were deposited by reactive magnetron sputtering in a vacuum chamber. Granulation tissue was evaluated histologically and immunohistochemically using antibodies against Ki-67 (clone SP6) and CD34 (clone QB-End/10). Ki-67-positive cells were counted, while vascularization was quantified as the number of CD34-positive vessels per $\times 100$ microscopic field. **Results.** Ta- and Ta_2O_5 -coated PPI induced formation of mature granulation tissue, whereas immature granulation tissue predominated around TaN-coated and uncoated PPI. Granulation tissue thickness was $1532.924 [1466.473; 1621.25]$ μm for Ta, $1496.35 [1447.758; 1522.85]$ μm for Ta_2O_5 , $1003.749 [887.535; 1041.892]$ μm for TaN, and $956.67 [899.52; 1012.158]$ μm for uncoated PPI. The numbers of CD34-positive vessels were 16 [14;17], 16 [15;18], 9 [8;12], and 9 [8;10], respectively, and Ki-67-positive cells were 47 [46;54], 46 [45;55], 37 [33;40], and 36 [29;40], respectively. Ta and Ta_2O_5 groups had greater granulation tissue thickness, vascularization, and Ki-67-positive cell counts than the uncoated PPI group ($p < 0.05$), whereas TaN did not differ significantly from uncoated PPI ($p > 0.05$). **Conclusions.** Ta and Ta_2O_5 coatings enhance proliferative activity, vascularization, and morphological maturation of granulation tissue surrounding PPI. TaN coating did not significantly improve these parameters compared with uncoated PPI after 28 days.

Keywords: tantalum, polypropylene implants, proliferation, angiogenesis, granulation tissue, rats.

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